IDAHO STATE WIDE WORK PLAN

FOR COMPLETING BENEFICIAL USE

ATTAINABILITY AND STATUS SURVEYS

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INTRODUCTION

In 1972 Congress passed public law 92-500, Federal Water Pollution Control Act, known as the Clean Water Act (CWA). The objective of this act is to "restore and maintain the chemical, physical, and biological integrity of the Nations's water's." The Federal Government, through the Environmental Protection Agency (EPA), assumed the dominant role in directing and defining water pollution control programs across the country. The law and the programs it spawned have changed significantly over the past 20 years as experience and perceptions of water quality have changed. The act has been amended 15 times since 1972, though most were minor, except for 1977, 1981 and 1987. The Idaho Division of Environmental Quality (DEQ) is the state agency responsible for implementing the CWA. EPA oversees and certifies that Idaho is meeting the requirements and mandates of the CWA.

The 1977 and 1981 amendments dealt primarily with construction grants for municipal and industrial dischargers. The 1987 amendment reaffirmed states responsibility for implementing the CWA. It created section 319, nonpoint source assessment of state waters. It encapsulates much of what has been learned about nonpoint source pollution sources and their control. Antidegradation, Stream Segments of Concern and Outstanding Resource Waters originate from this amendment.

One of the national goals listed in the 1977 amendment is protection and management of waters to insure "swimmable and fishable" conditions. This coupled with the original 1972 objective of restoring and maintaining the chemical, physical and biological integrity...relate water quality to more than just chemistry. In fact the CWA recognizes the water quality triad, that water quality is made of three major components; (1) chemical (2) physical habitat, and (3) biology dependent on the former two. In fact section 303 (c) (2) (B) of the CWA is even more explicate, "...such State's shall adopt criteria based on biological monitoring or assessment methods.." Section 304 (a) (1) goes further by stating, "State's shall develop and publish criteria for water quality accurately reflecting the latest scientific knowledge...on the effects of pollutants on biological community diversity, productivity, and stability, including information on the factors affecting rates of eutrophication and rates of organic and inorganic sedimentation for varying types of receiving waters."

Point Source pollution was the first element tackled under the original 1972 CWA. This was done for several reasons, primarily because it was known municipal and industrial discharges were contributing a large portion of pollutional loads to surface waters, and these point sources could be easily identified. Remediation and clean-up of these point sources was expensive and has resulted in significant improvements in the chemistry of waste water entering surface waters from point sources. However, programs to control nonpoint source (NPS) pollution were and remain today, largely unsuccessful because of the difficulties involved in applying point source approaches to diffuse NPS problems (Karr 1991). Karr also notes that efforts to measure or gauge water quality improvement have not been successful because of an inability to associate water quality standards with biological integrity. The realization that water quality standards do not always relate to biology and the fact that NPS pollution is complex, has lead water quality authorities to embrace the concept of ambient monitoring of biological integrity as being a direct, comprehensive indicator of ecological conditions.

Water quality standards are leagally established rules consisting of two parts; designated uses and criteria. Designated uses are the purposes or benefits to be derived from a water body and criteria are the conditions presumed to support or protect the designated uses (Karr 1991). Putsuant to the 1972 CWA the State of Idaho enacted water quality standards, which are intended to protect designated beneficial uses and human health (Table 1). Idaho beneficial uses include, but are not limited to:

Agricultural Water Supply
Domestic Water Supply
Industrila Water Supply
Cold Water Biota
Warm Water Biota
Salmonid Spawning
Primary Contact Recreation
Secondary Contact Recreation
Wildlife Habitat
Aesthetics

Use attainability surveys or analysis are the tools (procedures) used to identify or confirm whether or not a designated beneficial use is appropriate, given the water quality conditions present. Attainability surveys are also used to assist in making decisions on beneficial use status, when none existed previously. This enables the decision maker to base designations on real data not merely conjecture or professional opinions.

In 1993 DEQ embarked on a pilot program aimed at integrating biological and chemical monitoring along with physical habitat assessment, as a way of characterizing stream health, and hence the quality of the water and the watershed it drains. This program was called the <u>Beneficial Use Reconnaissance Project</u>. The objectives of the project were to demonstrate the usefulness and feasibility of assessing water quality by monitoring key chemical, physical and biological parameters. A second objective was to complete this monitoring as economically and quickly as possible with a minimum of people and equipment. The project demonstrated that the two objectives could be met and the data collected could be employed in a variety of ways. Because of the apparent success of the 1993 pilot, it was decided to expand the project state wide for 1994. A Technical Working Committee (TWC) was formed to evaluate the 1993 effort and arrive at a definitive work plan for 1994. The TWC was comprised of at least one member from each Regional Office with field monitoring experience as well a representative from DEQ Central Office for Monitoring and Technical Support. Members of the TWC are displayed below:

Member Name	Representing
Michael McIntyre	Southwest Idaho Regional Office (SWIRO)
Jack Skille	North Idaho Regional Office (NIRO)
Daniel Stewart	Northcentral Idaho Regional Office (NCIRO)
Derran Brandt	Southcentral Idaho Regional Office (SCIRO)
Dave Hull	Southeastern Idaho Regional Office (SEIRO)
Steve Robinson	Eastern Idaho Regional Office (EIRO)
Bill Clark	Central Office
Bob Steed	Central Office

ISSUES

Several pertinent points were brought out in discussion of a 1994 work plan. These salient elements helped the TWC focus objective development.

1. Since the project was expanding state wide to six different regions, the work plan needed to address consistency in the monitoring approach, data collection and reporting.

2. Given the number of diverse environments and hence stream systems found in Idaho, the work plan must be applicable to any stream regardless of where it is in the state.

3. Recognizing 2 above, how would streams be classified or stratified so that valid and meaningful data comparisons could be made?

4. What principal measures or collections tell us something significant about stream ecology, biology, and water quality, and what is the relationship of these to beneficial uses?

5. Many times reconnaissance surveys rely on qualitative or subjective data collection. Is this type of information enough to base beneficial use determinations, and how much quantitative data can be collected and yet be economically feasible?

OBJECTIVES

The issues noted above helped guide the Technical Working Committee in deciding what the objectives for this years project would be. They are:

1. Determine beneficial use attainability

2. Determine beneficial use support status, which includes characterizing reference stream conditions

These two objectives directed and influenced all the other decisions in this work plan, for instance stream selection criteria, parameters and methods for collection of data. The question asked by the committee as a whole was what data/information needs to be collected to answer 1 and 2 above. Secondly, is enough quantitative information being collected to collaborate the qualitative data. Lastly, how was the data to be used in answering, beneficial use support status.

Stream Selection Criteria

Idaho has many diverse environments within its borders, thus criteria for selecting streams to monitor has to be flexible enough to address the range of conditions encountered and yet be responsive to DEQ Regional Office needs. In meeting these constraints the TWC came up with several different criteria that came closest to satisfying all of these needs (not in order of priority). Appendix A is a list of the tentative streams to be surveyed this year by region.

1. Stream Segments Of Concern (from Idaho 319 Antidegradation policy)

2. Reference streams (potential streams will be surveyed to see if their conditions can be used to compare with other impacted streams).

3. Unknown streams (these are streams that have little to no monitoring information and are not designated for any beneficial use by Idaho Water Quality Standards. These streams are listed in Appendix D of the 1992 Idaho Water Quality Status Report.)

4. Water Quality Limited Streams (these are streams that the State of Idaho has determined not to support one or more beneficial use or fails to meet State Water Quality Standards. They are listed as 303 (d) of the 1994 Idaho Water Quality Status Report.)

5. Watersheds (within the framework of the Watershed Approach that DEQ is moving into)

METHODS

As noted earlier the two objectives for 1994 are to; (1) determine beneficial use attainability and (2) determine beneficial use support status, including characterization of reference stream conditions. These two objectives or questions if you will, drove selection of monitoring parameters and methods. Parameters were selected that directly or indirectly related to the objectives listed above. Since attainability focuses on beneficial uses, many parameters talk directly to those uses, for instance salmonid spawning and rearing, cold water biota, and primary and secondary contact recreation. Where use impact or status could not be evaluated directly, a surrogate measure was selected. In the case of beneficial use support, DEQ elected to make use of the reference comparison system described in Plafkin et al. (1989). This being the case, a minimum number of measures and collections are needed to adequately characterize reference stream conditions to determine the level of use support i.e., fully supported, impaired or not supported. Minshall (1993) also suggested using multiple measures because "it is unlikely that any one measure will have sufficient sensitivity to be useful in all circumstances".

A further caveat of this project is that the initial assessments and collections be done quickly and economically as possible. Lenat and Barbour (1993) put is best when they said "...to expend the minimum amount of effort required to get reproducible, scientifically valid results". Thus a trade off is required in the amount of information that is needed and that which can be obtained given time and budget constraints. The TWC felt the mix of parameters and methods selected met objectives and the time and budget constraints.

Keeping in mind the objectives for this project, the TWC reviewed similar projects in the Pacific Northwest as well as research studies for parameters and measures that yielded environmentally and biologically relevant information and or results. The objectives and germane studies formed the sideboards the TWC used in selecting parameters for inclusion in this project. These parameters became what the TWC referred to as the <u>core data set</u> (Table 2 and 3), that is, parameters each Regional Office field crew would do, regardless of where they were in the state. Each Regional Office is free to add additional parameters to meet site specific conditions or regional needs. These additions will be appended by each Regional Office. Conquest et al. (1993) notes that standardization of field methods is essential to ensuring reliable data and tailoring of published methods to site conditions is reasonable and valid.

Table 2. Physical parameters, methods and modifications for 1994 surveys.

Parameter	Method	Modification/Criteria
Flow	Platts et al. 1983 p. 10	Minimum of 1 measurement per site with 15 verticle velocity measurements per cross section
Width/Depth	Bauer and Burton 1993 p. 86	For wetted and bank full conditions at 3 different riffles
Shade (Canopy Cover)	Bauer and Burton 1993 p. 68 IDEQ #8-Classifying, monitoring, and evaluating stream/riparian vegetation in Idaho Rangeland streams p. 17	Measured with a densiometer at each riffle where insect, pebble count, and widths and depths are taken
Wolman Pebble Count	Wolman 1954 Bauer and Burton 1993 p. 108	At 3 riffles along with insects and shade, a minimum of 35 pebbles per riffle
Pool Riffle Ratio	IDEQ #3-Stream substrate, pool volume, and habitat diversity p. 4	Tape method recorded as percentage of stream length inventoried
Pool Complexity	Bauer and Burton 1993 p. 119 IDEQ #4-Evaluation and monitoring of stream/riparian habitats associated with aquatic communities in Rangeland streams.	Max. pool depth, width, cover and depth at pool tail-out
Large Organic Debris	Platts et al. 1987 p. 83	In forested situations only. LOD >10 cm diameter and > 1 m in length, within bankfull zone of influence

Table 2. Physical parameters, methods and modifications for 1994 surveys.

Parameter	Method	Modification/Criteria
Habitat Assessment	Taken from Robinson and Minshall 1992 p. 10	For Riffle/Run and Glide/Pool Prevalence
Rosgen Stream Classification	Rosgen 1885, 1993	Taken to alpha designation only
Bank Stability	Bauer and Burton 1993 p. 98	Entire reach, left and right banks

Table 3. Biological parameters, methods and modifications for 1994 surveys.

Parameter	Method	Modification/Criteria
Macroinvertebrates	IDEQ #5-Protocols for assessment of macroinvertebrates in Idaho streams Bauer and Burton 1993 p. 152	Hess sampler, with 500 μm mesh, at 3 successive riffles (n=3), each treated as a discrete sample
Fish	IDEQ #6-Protocols for assessment of fish in Idaho streams	Complete community work-up, two pass minimum for population estimates
Beneficial Use Attainability	IDEQ #7-Protocols for conducting use attainability assessments for determining beneficial uses to be designated on Idaho stream segments.	Modified according to needs and objectives of project (see tables ...)

Rational for parameter selection

Flow

Minshall (1993) noted that flow was one of the principal abiotic factors shaping stream ecosystems. Nelson et al. (1992) found flow to be one of the physical attributes that distinguished streams from different geologic regions. Flow is one of a series of measurements taken by both Oregon and Washington in very similar bioassessment projects (Mulvey et al. 1992, Plotnikoff 1992).

Width/Depth

Widths, depths and width to depth ratios were found by Robinson and Minshall (1992, 1994) to be useful in discriminating streams between ecoregions in Idaho. Nelson et al. 1992 and Overton et al. (1993) also found widths and depths to be important variables in separating streams from different geologic regions and with different degrees of management respectively.

Shade

Canopy cover as a surrogate for water temperature, since vegetation controls the amount of sunlight reaching the stream (Platts et al. 1987). Canopy cover was found to be an important variable in studies by Mulvey et al. (1992) and Overton et al. (1993). Temperature and canopy cover helped explain differences in fish occurrence and abundance in these studies as well as in Robinson and Minshall (1992, 1994) ecoregion study.

Wolman Pebble Count

Wolman pebble count is being employed as a means to characterize stream bottom substrates (Wolman 1954). This method will enable DEQ to make quantitative judgements on percentages of fines (defined as material <6.3 mm Chapman and McLeod 1987), gravel, cobble and boulder. Fine sediment and availability of living space have direct impact on both fish and insects (Marcus et al. 1990, Minshall 1984). Several studies and state projects have found relative substrate size to be important indicators of water quality impacts due to activities in the watershed (Overton et al. 1993, McIntyre 1993, Skille 1991). <u>Add the impact on mortality to early fish life stages by fines i.e. intergravel d.o. and capping for emergence.</u>

Pool Riffle Ratio

The amount of pools in a reach of stream is an indicator of the availability of rearing habitat for fish (Reiman and McIntyre 1993). Spawning typically takes place at pool tailouts in the transition between pool and riffles. However, as fish grow pools become more important as areas for rearing. Ratios less than 0.5 may indicate streams that are out of dynamic equilibrium with the amount of sediment being produced and the streams ability to transport it (Heede 1986).

Pool Complexity

This is a measure of pool quality, where pool riffle ratio is measure of pool quantity. In a study of streams that differed by the amount of management in their respective watersheds, Overton et al. (1993) found pools in the less managed stream/watershed were more frequent, had higher volumes and greater depths than those in the more managed stream/watershed. Beschta and Platts (1986) suggest that the quality of pools is equally as important as the number of pools in describing a healthy stream from a fisheries stand point.

Large Organic Debris
also called Large
Woody Debris

Large Organic Debris (LOD) has been found important in smaller sized streams where the riparian zone is made up of evergreens, i.e., forested situation (Everest et al. 1987). LOD has been found to be important for the complexity it adds to stream habitat, retention of allochtonous matter and sediment, and stability it imparts to streams under high flow conditions. Some species of salmonids show a high affinity for LOD (Rieman and McIntyre 1993). Clancy (1992) found a significant correlation between bull trout densities and LOD.

In addition to the above rational for parameter selection the TWC was equally concerned with the reliability, variability and repeatability of measurements. Platts et al. (1983) evaluated the accuracy and precision of some of the parameters listed above. Some were found to have lower confidence intervals than others, especially if they were rated as opposed to measured, though measure parameters had problems as well. They found measurements for stream width and depth to have good to excellent precision and accuracy. Subjective measures of percent pool and pool quality had good to fair precision, but generally fair to poor accuracy. Hogle et al. (1993) found ratings and measured values for streambank characteristics to have the highest variability in their study on the precision of habitat measurements. They concluded more quantitative definitions and measurements would reduce the variability associated with subjective ratings. In light of these the TWC tried to have quantitative measures taken where ever possible in lieu of a subjective rating. This is most evident in the habitat rating used as part of the use attainability procedure (see Appendix B).

Streams in Idaho exhibit considerable variability with regard to their climates, hydrology, geology, landforms, and soils. Recognizing this the TWC elected to use Rosgen's (1985) Stream Classification System as a means of organizing and stratifying streams for comparison. As Conquest et al. (1993) noted, "One way of organizing an inherently variable landscape is to employ a system of classification. The general intent of the classification (scheme) is to arrange units into meaningful groups in order to simplify sampling procedures and management strategies". This classification designation will be recorded on the cover sheet for each site. Additional descriptive items such as:

stream channel slope
stream name
location
crew members
date
visual observations
sketch of site
unique site identification number

will also be recorded on the cover sheet. Field sheets for 1994 are displayed in Appendix C. Photos will be taken of the stream; one downstream from the middle of the stream and a second facing upstream. More can be taken to document riparian conditions as deemed necessary.

PROCEDURE SEQUENCE FOR FILED COLLECTION

What follows is an example of how a crew might proceed once they have selected a representative sampling site.

1) Crew determines the appropriate length of stream to survey according to the following criteria:

a. if wetted width of stream is <3 m do a minimum of 100 m

b. if wetted width of stream is >3 m do 20 times bankfull width

2) Crew member measures out appropriate distance and marks beginning and ending points with flagging.

3) Take GPS coordinates if GPS equipment is available.

4) Descriptive cover sheet information is filled out i.e. stream slope, crew members, weather, location relative to some reference landmark, general observations.

5) Take a discharge measurement. Choose a spot with a relatively straight channel and uniform flow, where possible.

6) Locate first riffle upstream from beginning point, proceed to riffle.

7) Randomly select location for macroinvertebrate sample by either stretching tape across stream and using a random number for location or standing at toe of riffle facing downstream, throw hoop or implement over head up riffle, this then is the spot for taking the macroinvertebrate sample.

8) Place Hess sampler at point determined above. Take insect sample. Place sample into

a Whirl-pac or mason jar, label inside and out, and preserve with 70% ethanol (at least 1/2 to 3/4 of Whirl-pack or mason jar should be ETOH). Use additional alcohol if a high percentage of organics are present in sample.

9) Perform a Wolman pebble count immediately upstream from insect sample. Wolman pebble counts will be taken from high water mark on one side to the high water mark on the opposite side of the stream. Proportion counts so that a minimum of 35 pebbles are taken from the entire channel cross section. In smaller streams this may mean stepping above the first Wolman transect and conducting another pass. This may be necessary to repeat several times on very narrow streams. The opposite is true for wider streams, crew member strides will need to be adjusted to sample 35 pebbles from the entire cross section.

10) Once finished with Wolman pebble count, proceed to measure wetted and bankful widths and depths. Take several measurements to obtain a mean, i.e. at right bank middle and left bank (right bank and left bank are determined and referenced by looking upstream).

11) Take canopy closure (shade) measurement at riffle site where insect sample was collected. Measure at right and left bank, in the middle of stream facing upstream and another facing down stream.

12) Proceed to second riffle upstream from first and repeat procedures 7 through 11 above.

13) Proceed to third riffle from second and repeat 7 through 11 again.

14) Conduct riffle pool measurement by stretching tape length of stream to be surveyed and characterize as either pool or riffle for the entire length. Express this on the field sheets by percent of total length surveyed.

15) Conduct bank stability survey by rating each bank for the 4 different categories noted on the field sheets; covered and stable, covered and unstable, uncovered and stable, uncovered and unstable. Express as percentages. Use the tape that was used for obtaining the riffle pool measurement or use a 2 m pole.

16) Now that crew members are familiar with site, one of them should complete the use attainability field forms and accompanying habitat ratings.

17) Photographs of stream should be taken before leaving site.

18) If fish are to be done proceed further upstream where no disturbance has occurred, or return in a few days to allow fish to re-establish their territories.

QUALITY ASSURANCE/QUALITY CONTROL

This aspect of the Work Plan is one of the key components to any monitoring plan. To be successful, QA/QC must take into account who and how data is measured, recorded and transferred to insure that the data reflects actual field conditions. However, this type of monitoring doesn't lend itself to traditional QA/QC checks and balances, for instance, equipment calibration, duplicates and spikes. There are some basic procedures that can be implemented to assure the data is accurate and precise as possible. These are the procedures the TWC decided to use to insure QA/QC in the field up through data entry:

- Standardized methods/protocols for data collection
- Standardized training of crews
- Standardized field forms
- Maximizing quantitative data collection versus qualitative ratings
- Periodic field visits by independent observers from Central Office
- Two person review of field notes for accuracy and completeness before sending to data entry
- Voucher specimens for both macroinvertebrates and fish
- Laboratory QA/QC plan for macroinvertebrate handling and identification
- Unified State Work Plan

DATA HANDLING AND MANAGEMENT

As noted above in QA/QC, field notes will be reviewed by at least two people (preferably one from the crew and a RO BURP coordinator) for completeness and legibility. After this photo copies will be sent to the Central Office for data entry into a temporary lotus spreadsheet for storage. In the meantime a computer programmer/analysts will complete the development of a state wide BURP data base. This data base was started in 1993, but the programmer left before the it was completed. However, he did establish the data base framework or skeleton. A complete file, including field forms and maps will be maintained the Central Office, as well as at the respective Regional Office.

DATA ANALYSIS AND INTERPRETATION

The $BUPR_2$ field crews are responsible for collecting information and data necessary to make beneficial use attainability and use support status judgments. The interpretation and analysis of the data/results will be done by each respective Regional Office. As mentioned in methods, we will be using IDEQ #7-Protocols for conducting use attainability assessments for determining beneficial uses to be designated on Idaho stream segments. This protocol has been modified (see Appendix D) for our needs. The TWC decided to remove limited cold water and limited warm water biota use classification for simplicity and speed. The three use classifications that will be decided upon based on BURP data are; (1) cold water biota (2) salmonid spawning and (3) warm water biota. Where fisheries information does not exist on a stream and fish survey work is not done, a determination of cold water biota will be made based solely on the macroinvertebrate community make-up and the presence or absence or cold water indictor species (Appendix E). Use determination and use support status will be displayed on a form similar to Appendix ?, based on interpretation of the BURP data. As mentioned earlier we will be using the reference comparison procedure, described in Platfkin et al. (1989) for determining use support status. Where reference conditions are not found or enough reference conditions are found to arrive at a range of conditions, a theoretical reference condition will be generated, based on professional opinion. The beneficial use attainability forms and accompanying documentation will be the foundation for proposing new use designations (the board of Health and Welfare is the official designating agency) on streams that didn't have any previously and possibly changing existing designations. The use support information and results will be displayed in the next Idaho Bi-annual Water Quality Status Report, also refereed to as Idaho's 305 (b) Report.

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